

What we claim is:

1. A dosimetry assessment apparatus for determining the degree of exposure of a living subject to ionizing radiation, wherein said living subject has been previously exposed to an unknown but potentially harmful dose of ionizing radiation, said dosimetry assessment apparatus comprising:

a detection assembly able to target at least one chosen tooth in the mouth of a living subject and generate a test EPR spectrum from the targeted tooth, said assembly including

(i) a magnetic field generator of predetermined structure, dimensions and configuration and whose capacities and operating parameters are controlled to generate a stable and substantially uniform magnetic field strength of about 10 to 100 mT with a magnetic field uniformity of about 0.25% and a selected magnetic modulation field of about ± 0.1 to 0.5 mT with a magnetic field uniformity of about $\pm 10\%$ over the region of interest,

(ii) a resonator construct of predetermined dimensions and configuration which is adapted for engagement with at least one chosen tooth in the mouth of the living subject and whose operation allows for the emission of a radiowave of appropriate frequency for EPR measurement which is applied on-demand through the substance of the chosen tooth, and

(iii) an electron paramagnetic resonance (EPR) spectrometer which is integrated with said magnetic field generator and whose operation generates a test EPR spectrum which can show the presence and absence of a net magnetic moment within said substantially uniform magnetic field occurring in response to a radiowave of appropriate frequency being applied to the chosen tooth in the mouth of the living subject;

electronic detection equipment able to detect the presence and absence of a net magnetic moment within a test EPR spectrum;

electronic operating controls coupled to said detection assembly; and
a power supply integrated with said detection assembly.

2. The dosimetry assessment apparatus as recited in claim 1 further comprising a reference data library comprising the EPR spectra of specimen teeth before and after exposure to known doses of ionizing radiation.

3. The dosimetry assessment apparatus as recited in claim 1 further comprising a mathematical model library of predicted EPR spectra for teeth before and after exposure to known doses of ionizing radiation.

4. The dosimetry assessment apparatus as recited in claim 2 or 3 further comprising electronic comparison equipment for comparing a test EPR spectrum with said library of EPR spectra.

5. The dosimetry assessment apparatus as recited in claim 4 wherein said comparison of a test EPR spectrum with said library of EPR spectra is viewed as a readable output of ionizing radiation dose exposure.

6. The dosimetry assessment apparatus as recited in claim 1 wherein said magnetic field generator is ergonomically configured.

7. The dosimetry assessment apparatus as recited in claim 1 wherein said substantially uniform magnetic field is generated perpendicular to at least one chosen tooth in the mouth of the living subject.

8. The dosimetry assessment apparatus as recited in claim 1 wherein at least a part of said resonance construct is curved in configuration for engagement with a chosen tooth.

9. The dosimetry assessment apparatus as recited in claim 1 wherein at least a part of said resonance construct is oval in configuration for engagement with a chosen tooth.

10. The dosimetry assessment apparatus as recited in claim 1 wherein said magnetic field generator is composed of at least one naturally occurring and intrinsically magnetic material.

11. The dosimetry assessment apparatus as recited in claim 1 wherein said magnetic field generator is a manufactured electromagnetic structure.

12. The dosimetry assessment apparatus as recited in claim 1 wherein said apparatus is transportable on-demand.

13. The dosimetry assessment apparatus as recited in claim 12 wherein said transportable apparatus weighs less than 100 kilograms.

14. The dosimetry assessment apparatus as recited in claim 1 wherein said resonance construct can emit and apply a radiowave at a frequency ranging from about 0.3 -3.0 GHz.

15. A dosimetry assessment system for determining the degree of exposure of a living subject to ionizing radiation, said dosimetry assessment system comprising:

a basis for identifying at least one living subject suspected of having been previously exposed to an unknown but potentially harmful dose of ionizing radiation;

a dosimetry apparatus for measuring exposure to ionizing radiation in a living subject, said apparatus comprising

a detection assembly able to target at least one chosen tooth in the mouth of a living subject, said assembly including

(i) a magnetic field generator of predetermined structure, dimensions and configuration and whose capacities and operating parameters are controlled to generate a stable and substantially uniform magnetic field strength of about 10 to 100 mT with a magnetic field uniformity of about 0.25% and a selected magnetic modulation field of about +/- 0.1 to 0.5 mT with a magnetic field uniformity of about +/- 10% over the region of interest,

(ii) a resonator construct of predetermined dimensions and configuration which is adapted for engagement with at least one chosen tooth in the mouth of the living subject and whose operation allows for the emission of a radiowave of appropriate frequency for EPR measurement which is applied on-demand through the substance of the chosen tooth,

(iii) an electron paramagnetic resonance (EPR) spectrometer which is integrated with said magnetic field generator and whose operation generates a test EPR spectrum which can show the presence and absence of a net magnetic moment within said substantially uniform

magnetic field occurring in response to a radiowave of appropriate frequency being applied to the chosen tooth in the mouth of the living subject,

(iv) electronic operating controls coupled to said detection assembly, and

(v) a power supply integrated within said detection assembly;

a library of EPR spectra for teeth before and after exposure to known doses of ionizing radiation;

comparison means for comparing a test EPR spectrum with said library of EPR spectra; and

readable output equipment showing an exposure dose of ionizing radiation based on a comparison of test and library EPR spectra..

16. A dosimetry assessment method for determining the degree of exposure of a living subject to ionizing radiation, said dosimetry assessment method comprising the steps of:

identifying at least one living subject who is suspected of having been previously exposed to an unknown but potentially harmful dose of ionizing radiation;

obtaining a dosimetry apparatus for measuring exposure to ionizing radiation in a living subject, said apparatus being suitable for the targeting of at least one chosen tooth in the mouth of a living subject and comprising

(i) a magnetic field generator of predetermined structure, dimensions and configuration and whose capacities and operating parameters are controlled to generate a stable and substantially uniform magnetic field strength of about 10 to 100 mT with a magnetic field uniformity of about 0.25% and a selected magnetic modulation field of about +/- 0.1 to 0.5 mT with a magnetic field uniformity of about +/- 10% over the region of interest,

(ii) a resonator construct of predetermined dimensions and configuration which is adapted for engagement with at least one chosen tooth in the mouth of the living subject and whose operation allows for the emission of a radiowave of appropriate frequency for EPR measurement which is applied on-demand through the substance of the chosen tooth,

(iii) an electron paramagnetic resonance (EPR) spectrometer which is integrated with said magnetic field generator and whose operation generates a test EPR spectrum which can show the presence and absence of a net magnetic moment within said substantially uniform magnetic field occurring in response to a radiowave of appropriate frequency being applied to the chosen tooth in the mouth of the living subject,

(iv) electronic equipment able to detect the presence and absence of a net magnetic moment within a test EPR spectrum,

(v) electronic operating controls, and

(vi) an integrated power supply;

targeting said dosimetry apparatus to at least one chosen tooth within the mouth of a living subject;

operating said dosimetry apparatus to obtain a test EPR spectrum from said targeted tooth within the mouth of a living subject, said test EPR spectrum showing the presence or absence of a net magnetic moment within said substantially uniform magnetic field; and

detecting the presence or absence of a net magnetic moment of within said test EPR spectrum, wherein the presence of a net magnetic moment in said test EPR spectrum is a measure of the subject's previous exposure to ionizing radiation.

17. A comparative dosimetry assessment method for determining the degree of exposure of a living subject to ionizing radiation, said comparative dosimetry assessment method comprising the steps of:

identifying at least one living subject who is suspected of having been previously exposed to an unknown but potentially harmful dose of ionizing radiation;

obtaining a dosimetry apparatus for measuring exposure to ionizing radiation in a living subject, said apparatus being suitable for the targeting at least one chosen tooth in the mouth of a living subject and comprising

(i) a magnetic field generator of predetermined structure, dimensions and configuration and whose capacities and operating parameters are controlled to generate a stable and substantially uniform magnetic field strength of about 10 to 100 mT with a magnetic field uniformity of about 0.25% and a selected magnetic modulation field of about ± 0.1 to 0.5 mT with a magnetic field uniformity of about $\pm 10\%$ over the region of interest,

(ii) a resonator construct of predetermined dimensions and configuration which is adapted for engagement with at least one chosen tooth in the mouth of the living subject, whose operation allows for the emission of a radiowave of appropriate frequency for EPR measurement which is applied on-demand through the substance of the chosen tooth,

(iii) an electron paramagnetic resonance (EPR) spectrometer which is integrated with said magnetic field generator and whose operation generates a test EPR spectrum which can show the presence and absence of a net magnetic moment within said substantially uniform magnetic field occurring in response to a radiowave of appropriate frequency being applied to the chosen tooth in the mouth of the living subject,

(iv) electronic operating controls,

(v) an integrated power supply,

(vi) a reference data library comprising the EPR spectra of specimen teeth obtained before and after exposure to known doses of ionizing radiation; and

(vii) comparison equipment for comparing a test EPR spectrum with said reference data library of EPR spectra;

targeting said dosimetry apparatus to at least one chosen tooth within the mouth of a living subject;

operating said dosimetry apparatus to obtain a test EPR spectrum from the targeted tooth within the mouth of a living subject; and

comparing said test EPR spectrum with said reference data library of EPR spectra to detect the presence or absence of a net magnetic moment within said test EPR spectrum, wherein said comparison of EPR spectra provides a measure of the subject's previous exposure to ionizing radiation.

18. A comparative dosimetry assessment method for determining the degree of exposure of a living subject to ionizing radiation, said comparative dosimetry assessment method comprising the steps of:

identifying at least one living subject who is suspected of having been previously exposed to an unknown but potentially harmful dose of ionizing radiation;

obtaining a dosimetry apparatus for measuring exposure to ionizing radiation in a living subject, said apparatus being suitable for the targeting of at least one chosen tooth in the mouth of a living subject and comprising

(i) a magnetic field generator of predetermined structure, dimensions and configuration and whose capacities and operating parameters are controlled to generate a stable

and substantially uniform magnetic field strength of about 10 to 100 mT with a magnetic field uniformity of about 0.25% and a selected magnetic modulation field of about ± 0.1 to 0.5 mT with a magnetic field uniformity of about $\pm 10\%$ over the region of interest,

(ii) a resonator construct of predetermined dimensions and configuration which is adapted for engagement with at least one chosen tooth in the mouth of the living subject, whose operation allows for the emission of a radiowave of appropriate frequency for EPR measurement which is applied on-demand through the substance of the chosen tooth,

(iii) an electron paramagnetic resonance (EPR) spectrometer which is integrated with said magnetic field generator and whose operation generates a test EPR spectrum which can show the presence and absence of a net magnetic moment within said substantially uniform magnetic field occurring in response to a radiowave of appropriate frequency being applied to the chosen tooth in the mouth of the living subject,

(iv) electronic operating controls,

(v) an integrated power supply,

(vi) a mathematical model library comprising predicted EPR spectra of teeth before and after exposure to known doses of ionizing radiation, and

(vii) comparison equipment for comparing a test EPR spectrum with said mathematical model library of predicted EPR spectra;

targeting said dosimetry apparatus to at least one chosen tooth within the mouth of a living subject;

operating said dosimetry apparatus to obtain a test EPR spectrum from the targeted tooth within the mouth of a living subject; and

comparing said test EPR spectrum with said mathematical model library of predicted EPR spectra to detect the presence or absence of a net magnetic moment within said test EPR spectrum, wherein said comparison of EPR spectra provides a measure of the subject's previous exposure to ionizing radiation.

19. The dosimetry assessment method as recited in claim 17 or 18 wherein said comparison of a test EPR spectrum with said library of EPR spectra results in a readable output of the exposure to known doses of ionizing radiation.

20. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said magnetic field generator is ergonomically configured.

21. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said substantially uniform magnetic field is generated perpendicular to at least one chosen tooth in the mouth of the living subject.

22. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein at least a part of said resonance construct is curved in configuration for engagement with a chosen tooth.

23. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein at least a part of said resonance construct is oval in configuration for engagement with a chosen tooth.

24. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said magnetic field generator is composed of at least one naturally occurring and intrinsically magnetic material.

25. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said magnetic field generator is a manufactured electromagnetic structure.

26. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said apparatus is transportable on-demand.

27. The dosimetry assessment method as recited in claim 16, 17 or 18 wherein said resonance construct can emit and apply a radiowave at a frequency ranging from about 0.3 -3.0 GHz.